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ABSTRACT

This study investigated whether Chapter 1 middle school students showed more achievement gain when delivery of the pull-out supplementary reading or mathematics instruction was "massed" in time blocks or "distributed" weekly across the school year. All students in one Middle School Chapter 1 Learning Center program participated in the study. Approximately 250 students in supplemental reading and 260 students in supplemental math were randomly assigned to one of three delivery schedules for receiving Chapter 1 services throughout the school year. The Learning Center had four Chapter 1 teachers and four Chapter 1 assistants (two of each for both reading and mathematics). Analysis of the end-of-year California Achievement Tests (CAT) total reading scores, using fall achievement scores as a covariate, showed a marginally significant group effect favoring the once-per-week delivery schedule. A similar analysis of CAT total math scores showed no significant differences across the delivery schedules, although the once-per-week group did have the highest posttest mean. Two figures provide reading and mathematics results by group and by grade. (Author/TJH)

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The Effects of Differential Delivery Schedules in a Middle School Chapter 1 Program

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Abstract

This study investigates whether Chapter 1 middle school students showed more achievement gain when delivery of the pull-out supplementary reading or math instruction was "massed" in time blocks or "distributed" weekly across the school year. Approximately 250 students in supplemental reading and 260 students in supplemental math were randomly assigned to one of three delivery schedules for receiving Chapter 1 services throughout the school year. Analysis of the end of year California Achievement test total reading scores using fall achievement scores as a covariate shows a marginally significant group effect favoring the once-per-week delivery schedule. A similar analysis of California Achievement Test total math scores shows no significant differences among the delivery schedules, although the once-per-week group did have the highest posttest mean.

The Effects of Differential Delivery Schedules in a Middle School Chapter 1 Program

Research relating to the effects of massed vs. distributed practice has come primarily from experiments conducted in a laboratory setting. Further, because mastery of content presented in the public school classroom represents "long and difficult learning situations", it has been noted by some researchers (e.g., Bloom and Shuell, 1981) that laboratory manipulations of variables involved in human learning have limited practical generalization to the school classroom situation. As Powell (1976) has pointed out, studies of retention in the laboratory with lists of nonsense syllables are not comparable with the "retention of material learned in school" (p. 18). Additionally, although investigations of massed vs. distributed practice have been conducted with adolescent age (Drake, 1981) and elementary school age children (Waterstreet, 1978) in vocational education or foreign language acquisition, there have been almost no studies either in regular or compensatory educational classrooms exploring the effects of differential scheduling with content area subjects like math, reading, or social studies.

This study was conducted to determine whether Chapter 1 students would show more achievement gain when the delivery of the pull-out supplementary reading or math instruction was "massed" in time blocks or "distributed" weekly across the school year.

Method

Subjects

All students in one Middle School Chapter 1 Learning Center program participated in the study. There were approximately 250 students in the supplementary reading and 260 students in the supplementary mathematics programs. The Learning Center had four Chapter 1 teachers and four Chapter 1 assistants. There were two of each for both reading and math.

Groups

Chapter 1 students at each grade level were assigned to one of the following treatment groups:

Group 1. Once a week cycle

Group one attended the learning center for one day per week (50 minutes per day). The remaining four days per week of reading or math instruction were spent in the regular classroom.

Group 2. Two week cycle

Group two spent one period per day for two consecutive weeks in the learning center, followed by eight weeks in the regular classroom. Throughout the year, this group had three concentrated or "massed" sessions in the learning center.

Group 3. Three week cycle - once each semester

Group three attended the learning center for one period daily for three consecutive weeks. The remaining 12 weeks of each semester were spent in the regular classroom (two "massed" sessions throughout the year).

Students in each group were assigned to the learning center for an average of 28.4 days, or 1,420 minutes throughout the year. Therefore, all groups were scheduled for the same amount of supplementary instruction. Absentee rates were examined post-hoc to determine any effects of differences in actual attendance rates.)

Design

The Chapter 1 teachers' schedules were designed so that each teacher taught students from each scheduling system throughout the school year. This was accomplished by having each teacher teach two periods with one method, two periods with a second method, and one period with a third method. For example, the

schedule for one of the Chapter 1 teachers is presented below:

Period 1	One day a week group
Period 2	Three consecutive weeks group
Period 3	Planning
Period 4	One day a week group
Period 5	Two consecutive weeks group
Period 6	Three consecutive weeks group

The experimenters prepared the teaching schedules for each teacher. All three student treatment groups were assigned an equal amount of time across teachers and were spaced throughout the school day. Therefore, there were approximately equal numbers of students per grade and across grades taught by each method. Time of day should not have been a biasing factor favoring any treatment system.

Procedure

During the first week of school, Chapter 1 teachers were inserviced regarding the design of the study and were given a list of the scheduling methods they would follow for each class period and the names of students assigned for each period.

Students for each class period (representing one of the treatment conditions) were divided into five groups. Each group was given a color code. The teachers were supplied with three colored calendars illustrating the once a week, the two consecutive weeks, and the three consecutive weeks scheduling plans. The days that the students in each group were to attend

the learning center were indicated on the calendar with the color code of each group. Names of alternate students were also supplied for each class period, to allow for student attrition.

Chapter 1 eligible students were pretested with the California Achievement Test during the week of September 22. Posttesting was conducted during the week of May 3-7. Only those students who attended the learning center for the entire year were included in the analysis.

Approximately once a month throughout the school year, the experimenters observed the Chapter 1 classes and interviewed the Chapter 1 teachers to determine the perceived strengths and weaknesses of each scheduling system, as well as to assess whether similar instructional processes were occurring in each group.

Results and Discussion

The analysis of covariance design was used to adjust statistically any initial differences in students' achievement levels. Prior to using each covariance analysis, a check was made on the assumption of homogeneous regression coefficients. Each preliminary test indicated that the assumption of equal regression slopes was tenable, thus permitting the use of the conventional analysis of covariance.

Insert Figure 1 about here

The first analysis (3 groups by 3 grades, adjusting for pre-achievement level) compared post-test reading scores. Results showed a significant main effect for grade ($F=6.83$, $d.f.=2/203$, $p<.001$), a marginally significant main effect for group ($F=2.86$, $d.f.=2/203$, $p<.059$), and no interaction effect. Post hoc comparisions using linear models showed that the once-per-week group out performed both of the "massed" treatment groups and that sixth graders outperformed both seventh and eighth grade students.

Insert Figure 2 about here

A similar analysis (3 groups by 3 grades, adjusting for pre-achievement level) was performed using post-test math scores. Results indicated a significant grade effect ($F=748.03$, $d.f.=2/215$, $p<.0001$) with 6th grade students again superior to 7th and 8th grade students. Again, the once-per-week group had the highest post-score performance, although the group effect was non-significant ($p=.40$).

These results provided evidence that distributing the Chapter 1 instruction in reading across the entire school year, rather than massing it in two or three week time blocks, was beneficial to this student population. In math, the results were in the same direction but were not statistically significant.

In a quasi-experimental design such as this, the inability to control for other influential variables could produce apparent between-group results which were independent of the treatment effects. Several post-hoc analyses were conducted to attempt to determine the degree to which the following uncontrolled variables may have influenced the between-group results. First, was there a Chapter 1 teacher effect across grades? Second, were there differential attendance rates among the treatment groups? Third, was there a significant "regular classroom teacher influence" which may have differentially effected the Chapter 1 Learning Center groups?

Even though the Chapter 1 teachers were counter-balanced across treatment groups, they were not counterbalanced so that each teacher taught all grades. For both reading and math, one Chapter 1 teacher taught all of the 6th graders and one-half of the 7th graders, and the other Chapter 1 teacher taught all 8th graders and one-half of the 7th graders. To determine if the

differential achievement shown by the 6th graders was a grade specific effect or a teacher-produced effect, the 7th grade students were analyzed separately using a similar analysis of covariance design to those discussed earlier. The results indicated that the grade-level achievement difference was not due to the Chapter 1 teacher.

Analysis of variance (3 groups by 3 grades) was used to determine if there were differences in attendance rates or in number of minutes of instruction across the three treatment groups or across the three grades. The results were non-significant.

The most difficult "uncontrolled" variable to assess was the regular classroom teacher effect. As Chapter 1 students received four-fifths of their reading and of their math instruction from their regular classroom teacher, the potential for a superior classroom teacher to confound the Chapter 1 delivery system effects was considerable. The measure utilized for estimating the classroom effect was the variable representing teacher submissions of criterion-referenced mastery tests (a rough index of the degree of use of the system). Previous research (Kimball, 1982) indicated a positive relationship between the use of a criterion-referenced testing system and scores on the California

Achievement Test. The criterion-referenced management systems used for reading were the Prescriptive Reading Inventory/Reading Systems (PRI/RS) published by McGraw/Hill. The criterion-referenced management system used for mathematics was the Diagnostic Mathematics Inventory (DMI) which is also published by McGraw/Hill.

The analysis of variance was used to determine if the number of criterion-referenced objectives mastered differed among the three Chapter 1 delivery system groups. Results showed no difference in the number of PRI/RS objectives mastered by group. However, the between group differences on the number of DMI objectives mastered was significant favoring the 2-week and 3-week groups.

To determine if differential use of the DMI by regular classroom mathematics teachers masked the effects of the Chapter 1 once-per-week treatment, a second analysis of covariance was conducted using two covariates. The covariates were pre-achievement scores and number of criterion-referenced test (DMI) objectives mastered. The results came closer to showing a group effect ($F=1.51$, $d.f.=2/214$, $p=.22$). Again, the once-per-week group had the highest post-score performance.

Perceptions of Teachers

The regular language arts and mathematics classroom teachers were interviewed by the experimenters in March. Of the eleven interviewed, six teachers preferred the three-week group, one preferred the two-week group, and four preferred the once-a-week group. The reasons stated by those teachers choosing the two and three-week groups were that classes seemed to be disrupted less, tests were easier to schedule, and more uninterrupted class time could be spent on PRI/RS and DMI objectives. They also stated that pulling the students out of class once a week caused them to lose interest and fall behind in regular classroom assignments.

On the other hand, teachers preferring the once-a-week group stated that students kept up in their daily assignments better and benefitted from the more predictable routine. These teachers commented that students having longer intervals between learning center visits seemed to have more difficulty in catching up in the regular classroom when they returned.

The preference expressed by all Chapter 1 teachers was for the two and three consecutive week groups. These teachers stated that students made more progress in the learning center when they came for several days in a row.

Despite some teacher preferences to the contrary, it appears that distributing learning center services to Chapter 1 eligible students across the entire school year produces higher achievement than "massing" the same amount of instruction in blocks of time during the year. It also appears that students in the sixth grade make greater gains than seventh and eighth graders regardless of which delivery system is used.

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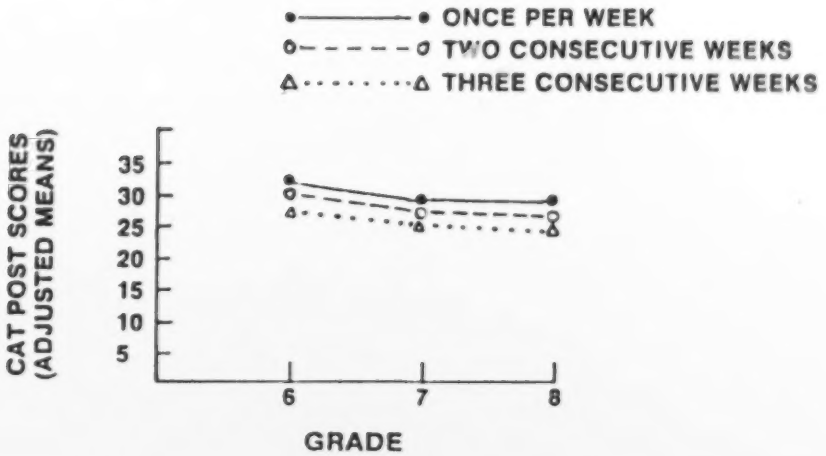
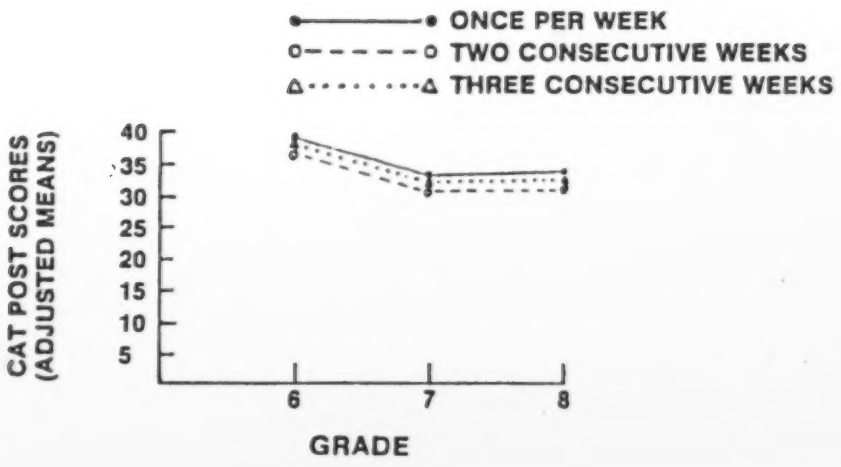
FIGURE 1
READING RESULTS BY GROUP BY GRADE



Source	Sum of Squares	df	Mean Square	F	Signif. of F
Covariates (Pre Score)	4630.92	1	4630.92	89.36	.0001
MAIN EFFECTS					
Treatment Group	296.70	2	148.35	2.86	.059
GRADE	708.42	2	354.21	6.83	.001
TWO-WAY INTERACTIONS					
Treatment Group By Grade	118.44	4	29.61	0.57	.684

FIGURE 2
MATH RESULTS
BY GROUP BY GRADE



Source	Sum of Squares	df	Mean Square	F	Signif. of F
Covariates (Pre Score)	2636.97	1	2636.97	34.78	.0001
MAIN EFFECTS					
Treatment Group	138.28	2	69.13	0.91	.403
GRADE	1496.05	2	748.03	9.87	.0001
TWO-WAY INTERACTIONS					
Treatment Group By Grade	519.31	4	129.83	1.71	.148